FILE: ACT/035/002

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DIVISION OF OIL
GAS & MINING

January 3, 1985

Mr. Steve Taylor
Environmental Affairs
Kennecott Copper Corporation
Salt Lake City, Utah

417 Wakara Way
Salt Lake City, Utah 84108
(801) 582-0144
TELEX 820832NPISLC

Dear Steve:

Please find enclosed the preliminary results of soil analyses for samples collected on December 23, 1985. Subsamples of soil were taken at each of three different locations within the site area. The top 12 inches were reported as a surface sample. Soil from 12 inches to 60 inches were pooled to provide a subsurface sample. A summary of the test results follow together with an interpretation regarding the suitability of the subsurface soils as a topsoil substitute. Considerations for revegetation are based on a post-mining land use of rangeland and wildlife habitat with a fairly level topography.

Soil pH

Soil pH values averaged 6.2 for the surface sample and 7.6 for the subsurface sample, although averages may not adequately reflect the pH values as pH is a logarithmic scale not a linear scale. Nevertheless soils with similar pH values represent those that are generally believed to be suitable as topsoil substitutes. The subsoil has a slightly higher pH which probably results from the higher clay content of the soils.

Soluble Salts

Soluble salts as measured by electrical conductivity (mmhos/cm) were generally quite low. The surface soils averaged 0.4 while the subsurface soils averaged 0.9. Usually values below 8.0 are considered suitable for topsoil substitutes. Values 8.0 to 12.0 are considered marginal.

Saturation Percentage

Saturation percentage is a measure of how much water is present in a sample at saturation. The surface soils averaged 48% while the subsurface averaged 68%. Soils with values of from 25% to 80% are usually considered suitable as topsoil substitutes while values of less than 25% and greater than 80% are considered marginal.

Texture

The surface soils averaged 28.3% sand, 36.6% silt and 35.0% clay, while the subsurface soils averaged 28.3% sand, 23.7% silt, and 47.4% clay. The surface soils are categorized as clay loam soils while the subsurface soils are categorized as a clay soil. It should be pointed out that greater than 40% clay is near the cutoff for categorization as a clay soil, indicating that the soils are close to a clay loam soil, but have sufficient clay to be categorized as a clay soil. While the subsoils have considerable clay and may require appropriate management techniques during topsoil spreading and revegetation, it is believed that several species of native vegetation are adapted to such soils and will meet the post-mining land use as we understand it for the site. Because the topography of the site will be relatively flat, no severe erosion problems are anticipated.

Sodium Absorption Ratio

Sodium absorption ratios for the surface soil averaged 1.3 while SARs for the subsurface averaged 2.3. Values of SAR between 0 and 10.0 are considered suitable for topsoil substitutes. No problems are anticipated from excessive sodium in the soils despite the higher clay content of the subsoils.

Selenium

Selenium values for the surface and subsurface soils were all less than 0.05 ppm. Soils with selenium values of less than 0.1 ppm are considered suitable, while soils with values of greater than 0.1 ppm are considered marginal. No problems are anticipated with excessive selenium in the topsoil or subsoil materials.

Boron

Boron values for the surface soil averaged 1.1 ppm while boron values for the sursurface soils averaged 0.8 ppm (dry-soil-weight basis). Soils with boron values of less than 5.0 ppm are considered suitable for topsoil substitutes and values greater than 5.0 ppm are considered unsuitable. No problems are anticipated from excess boron in the subsoils.

Coarse Fragments

Coarse fragments in all samples tested for surface and subsurface averaged less than 25%. Soils with less than 25% coarse fragments are considered as suitable as a topsoil substitute, while those of from 25% to 35% are considered marginal, and those with greater than 35% are considered

unsuitable.

Revegetation Potential

No major soil parameters were identified that would preclude the revegetation of the site with suitable rangeland species of vegetation and appropriate revegetation practices. Additional emphasis should be given to handling of subsoil materials to be used as topsoil substitutes to ensure that excessive compaction and crusting does not occur due to handling soil materials while they are wet, and that no steep slopes are generated during the final contouring. Fertilization with appropriate rates is recommended to assist vegetation establishment during the first few years.

The final analyses will include information regarding the methods used etc.

Please feel free to call me should you have further questions regarding our soil analyses or interpretation.

Sincerely,

Dennis Hansen

Dennis J. Hansen, Ph.D.

Enclosure

DH

Kennecott
6 Soils
January 2, 1986

NPI Soil Testing/Plant Tissue Analysis Laboratory
417 Wakara Way, Salt Lake City, UT 84108
(801) 582-0144, Ext. 371, Von Isaman

Sample	pH	EC mmhos/cm	Sat %	Coarse Fragments %	Se ppm	B ppm	Sand %	Silt %	Clay %	Texture Class *	Ca meq/l	Mg meq/l	Na meq/l	SAR
Hole 1 0-1'	6.40	0.50	52	<25	<0.05	1.3	27.4	34.0	38.6	CL	3	2	3	2
Hole 1 1-5'	7.79	1.82	69	<25	<0.05	1.2	18.7	28.7	52.6	C	8	2	11	5
Hole 2 0-1'	6.35	0.61	50	<25	<0.05	.6	27.4	38.0	34.6	CL	6	1	1	1
Hole 2 1-3'	7.48	0.43	69	<25	<0.05	.5	31.4	16.0	52.6	C	3	1	2	1
Hole 3 0-1.5'	5.91	0.22	42	<25	<0.05	1.3	30.2	38.0	31.8	CL	1	<1	1	1
Hole 3 1.5-5'	7.56	0.38	66	<25	<0.05	.8	36.3	26.6	37.1	CL	3	1	2	1

*CL = Clay Loam
C = Clay